MANPRINT BULLETIN

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Army and Industry Working Together

Shirley C. Rubens
Project Manager for Training Devices (PM TRADE)

The incorporation of MANPRINT into training device acquisitions has offered new and difficult challenges to the training device community. Low priority and visibility, a shortage of trained people, and a lack of explicit training device or simulator MANPRINT guidance have contributed to the confusion and reluctance to implement the program. To remedy the situation, PM TRADE sponsored a one-week MANPRINT course in March 1987 for representatives from the training and materiel development communities and industry. Participants had difficulty, however, in adapting weapon system regulatory guidance and methodologies to training device acquisitions. It became clear that total MANPRINT implementation would require both government and industry understanding and commitment.

In the Army Materiel Command (AMC) MANPRINT Videoconference held August 4, 1987, COL William Murry urged all AMC agencies to open a dialogue with industry; from this recommendation, the idea for the Joint Army/Industry MANPRINT Working Group was conceived. The group's goal was to improve communication between government and industry by learning to apply and tailor MANPRINT initiatives to training device acquisitions.

COL Richard J. Lunsford, Project Manager for

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View From the Top: An Interview with the Army Vice Chief of Staff

We are pleased to announce the debut of a new column entitled "View From the Top." This series, which will feature conversations with key leaders in the MANPRINT community, commences on page 4 with an interview with the Vice Chief of Staff of the Army, General Arthur E. Brown, Jr. We hope you enjoy this new feature!

In addition to the VCSA interview, you will find inside...

"Remember the Soldier"

Army and Industry (continued from page 1)

Training Devices, opened the group's first meeting, which was held in December, 1987. Ms. Shirley Rubens, the PM TRADE MANPRINT Manager, was designated chairperson; Mr. Oscar Dorr of AAI Corporation was chosen to serve as co-chairperson and industry coordinator. The group's participants included representatives from PM TRADE; Training Performance Data Center (TPDC); Naval Training Systems Center (NTSC); Human Engineering Laboratory (HEL); and the U.S. Army Training Support Center (USATSC). Industry representatives included managers and hardware developers from Harris Corporation; AAI Corporation; Hay Systems, Inc.; Martin Marietta; Educational Computer Corporation (ECC); General Electric (GE); Science Applications International Corporation (SAIC); and the University of Central Florida Institute for Simulation and Training (IST). Prerequisites for admission to the group included possession of a basic understanding of MANPRINT goals and principles, as well as actual working involvement in the development of training devices, training systems, or simulators. Location of the meetings, which are held every four to six weeks, rotate among the local contractors' facilities and PM TRADE, thus avoiding the appearance of government domination. Local liaison offices of the Army Research Institute (ARI) and the U.S. Air Force closely follow the proceedings.

The first few meetings consisted of presentations and discussions of MANPRINT policies and procedures. Concurrently, a Plan of Action for improving communication lines was developed from the attendees' written goals and objectives. To meet the maximum number of goals, members planned a step-by-step walk-through of the entire development process utilizing a ficticious non-system training device requirement called the Armageddon Training Device. The procedures, tools, methodologies, and criteria best suited for the project would evolve as issues and concerns are discussed and evaluated.

In accordance with the Plan of Action, group members were separated into four sub-groups (A through D), each assigned a specific portion of the acquisition process. Information packets prepared exclusively for the Armageddon Training Device were distributed; these packets consisted of a Training Device Needs Statement (TDNS), a Preliminary Training Development Study (PTDS), Media Analysis, high-level Task Analysis, and a cursory Target Audience Description (TAD). Each sub-group was asked to analyze existing information, identify data sources, review existing policies and procedures, develop draft products which highlight key MANPRINT-related considerations, and develop summary documents; their findings are then presented to the working group. (See Figure 1.) Sub-group A will review the hypothetical materials and develop both a System MANPRINT Management Plan (SMMP) and Training Device Requirement (TDR). Sub-group B will utilize this output to develop a Request for Proposal (RFP). Sub-group C will use these documents and other related materials to develop a proposal, and sub-group D will walk through the Source Selection Evaluation Process.

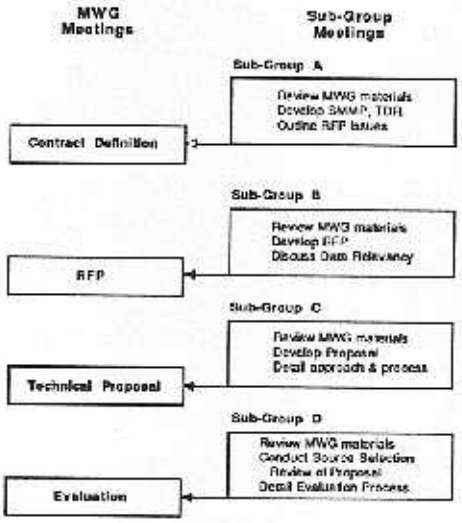

Figure 1. Meeting-by-Meeting Activities

The results of the overall effort will be documented and coordinated with appropriate organizations. The group intends to produce a compilation of the proceedings and possibly a handbook on MANPRINT and training device acquisitions, which will be made available for all involved in the business of materiel acquisition.

The Joint Army/Industry MANPRINT Working Group members and PM TRADE are enthusiastic over this novel approach to resolving a highly complex, confusing issue. They and others will continue to work diligently to address any difficulties involving MANPRINT and training device acquisition.

For more information, contact Ms. Shirley Rubens at PM TRADE, AMCPM-TND-SLG, Orlando, FL 32813-7100, AV 791-5757 or COM (305) 646-5757.

MANPRINT Risk Assessment: A Pilot Test

Beth Redden
Human Engineering Laboratory Field Office
Fort Benning

CPT Ted Barlla
Soldier Support Center-National Capital Region

The first MANPRINT Risk Assessment (MRA) was recently completed at the U.S. Army Infantry School (USAIS). The purpose of performing this assessment was two-fold: (1) to determine the level of MANPRINT risk associated with performing a successful MANPRINT Program on the emerging Infantry Self Defense System (DAZER), and (2) to provide feedback to the Soldier Support Center- National Captial Region (SSC-NCR) on the mechanics and usefulness of the MRA—in other words, to perform a pilot test.

This MRA was performed early in the acquisition cycle of the DAZER system, prior to Operational and Organizational (O&O) Plan and System MANPRINT Management Plan (SMMP) development, to help determine which specific MANPRINT tasks should be performed. A system whose MRA results indicate high risk in a MANPRINT area should have SMMP tasks developed which emphasize work in that area. The results of the MRA could also be used to write the Early Availability of Data Risk Analysis (paragraph 3b2) in the SMMP.

In addition to an assessment of MANPRINT risk, USAIS found that the MRA provided several benefits. By completing the MRA, the Materiel Systems Project Officer (MSPO) is made aware of available resources, as well as potential problem areas which previously may not have come to his attention. The assessment also introduces the MSPO to new concepts, techniques and terminologies.

The MRA has recently been automated into a Lotus worksheet, making it much simpler to use. Because of our positive experience, we feel confident in recommending its use to others in the materiel acquisition business.

For more information, contact CPT Ted Barlla, SSC-NCR, ATNC-NMF-AIB, Alexandria, VA 22332-1345, AV 221-8779/3249, or COM (703) 325-8779.

★★★★

TRADOC SMMP UPDATE

CDR TRADOC FT MONROE VA//ATCD-SP//
AIG 7443

SUBJECT: MANPRINT Update Message No. 88-2, Development and Staffing of the System MANPRINT Management Plan (SMMP)

A. Draft TRADOC/AMC PAM 602-XX, 25 May 87.

1. The purpose of this message is to clarify TRADOC procedures and policy contained in Ref A on developing and staffing the System MANPRINT Management Plan (SMMP).

2. The requirement to consider MANPRINT concerns has not been "grandfathered." If the MANPRINT Joint Working Group (MJWG) determines a system will have minimal MANPRINT impact, the MJWG can develop an abbreviated SMMP (Ref A, Para 5-2B).

3. The Director of Combat Developments is responsible for initiating the MJWG. The MJWG has responsibility for writing the SMMP, and it is critical to the MANPRINT effort that representatives from all six domains are involved. The system proponent determines the exact makeup of the MJWG (IAW Chapter 3, Para 3-2 of Ref A) based on the assets available and the type of acquisition conducted.

4. Many centers and schools are sending "skeleton" SMMPs for staffing and comment which are intended solely to prepare members of the MJWG for their initial meeting. Staffing such SMMPs prior to input from the MJWG members adds to everyone's workload and reinforces the impression that TRADOC system proponents do not know how to identify MANPRINT concerns on their systems. These "skeleton" or boilerplate SMMPs should be staffed only with members of the MJWG.

5. The intent of the guidance contained in Chapters 4 (Section 1, Event 2) and 5 (Para 5-4) of Ref A is to tell where to staff the SMMP for comment, after development by the MJWG, prior to submitting it for approval by the commandant.

6. Please use the following procedures in develop-

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VIEW FROM THE TOP

An Interview with the Vice Chief of Staff of the Army

General Arthur E. Brown, Jr.

Editor's Note: On June 1, 1988, the Army Vice Chief of Staff was interviewed exclusively for the "MANPRINT Bulletin" by Richard Patrick of Automation Research Systems, Limited.

Q: General Brown, MANPRINT practitioners in both government and industry would like to get some indication of how the Army leadership perceives MANPRINT, both its successes as well as any possible failures or difficulties that the program might be experiencing at this time. I'm going to start this interview by mentioning the cuts in the defense budget. These cuts obviously affect the Army's ability to fund all of its requirements. In light of that, is the Army willing to continue its emphasis on MANPRINT? Will resources be provided for MANPRINT?

A: Let me begin by saying that you have to look at the overriding theme of what the Army's all about. A lot of people say that the other services man equipment and the Army equips men. If you start with that premise, then you accept that people are our most important commodity. The equipment we develop and issue is for men and women—soldiers—to use to perform their duties. The Army is dedicated to taking care of its people, so therefore, the whole idea of manpower and personnel, human factors engineering, safety, training, and health hazards—the six domains of MANPRINT—is fundamental. It is what we are all about.

So if you say okay Army, you're now going to be reduced in your budget, which we are, then the day of belt-tightening is here. The Army now has to get away from the non-essentials and focus solely on the essentials. If you go back to the premise that says people are our essential element, and that we equip our men and women instead of merely manning our equipment, then you say more focus ought to be on the kinds of things that MANPRINT is all about. Our day of reckoning is on the battlefield. So we need to develop equipment that optimizes our soldiers' ability to accomplish their mission.

So that's a long way of answering your question. I'd say the budget cuts are an opportunity to be more focused on the human aspect.

I would like to add that, it seems to me, MANPRINT has been personality-driven rather than institutionally-driven. The effort has been to drive it into the system—to embed it in the system—based on personalities. MANPRINT should be institutionalized from the standpoint of the schoolhouse, from the standpoint of the acquisition process, and the review process. We have to continue to change the mindset of all people rather than depend upon a few to drive it into the system. The time is now to embed that whole philosophy of the man/machine interface.

Q: Then ideally, you see a need for the Army to give the full MANPRINT treatment to those programs that have extensive soldier/machine interface concerns?

A: Yes. Let's take an example. One of the major programs we have ongoing is the LHX [Light Helicopter Experimental]. It's been through a lot of ups and downs in the past few years, a lot of disagreement about one crewman, two crewmen, and about the ability of man to capture high technology and to leap ahead in developing such a weapon system.

The man/machine interface is fundamental to the LHX. Those who advocate a one-pilot aircraft are counting on

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an optimal relationship between man and machine. I was looking over the required operational capabilities [ROC] statement this morning, and it is the MANPRINT aspect of it that is essential—it's right up front in the ROC.

Q: As the Army moves into acquisition streamlining to comply with DOD Directive 5000.43—and doing a good job, I might add—the Army is starting to accept more trade-offs. Are there any safeguards to ensure that MANPRINT requirements and concerns are not arbitrarily traded off?

A: The world is full of trade-offs. There are trade-offs in weight, there are trade-offs in expense, there are trade-offs in capabilities and how much you pay for it. But the review process is where we try to capture that. And do we do it well enough? No, we will never do it well enough. But again, it gets back to the need to institutionalize the whole business of what MANPRINT is all about.

As an example, for a long time people in the Army believed that you couldn't put a seatbelt on a combat vehicle because it slowed the person from exiting the vehicle in the event that it wound up in some kind of trouble. As a result, we didn't put seatbelts on a quarter-ton truck, a jeep, until last summer. 1987! That's incredible! We've had a federal requirement for seatbelts to be in passenger vehicles for years.

There was a notion that you didn't want to put in overhead protection because it impeded people from getting out of the vehicle. Well, last summer we made a decision—this is the safety-related aspect of MANPRINT—to put roll bars and seatbelts on the 151 vehicles [jeeps]. We've had incredible results with that. I made the decision to go ahead and put the system in—its called ROPS (Roll Over Protection System), which involves strengthening of the frame and putting in roll bars and seatbelts. That is an example of a trade-off in favor of a MANPRINT approach—a human safety of approach versus a tactical or operational approach.

Another type of trade-off is what I call the MANPRINT-security dilemma. We're in the process of fielding the Multiple Subscriber Equipment (MSE) down at Fort Hood...I was down there the other day. General Saint has the responsibility of determining where in vehicles the pieces of equipment go, both from a standpoint of user-friendliness and a standpoint of operational security, in the HMMWV [High Mobility Multipurpose Wheeled Vehicle], which is the replacement for the 151 jeep. We put the main receiver/transmitter behind the right front seat and positioned it so that the face of the radio is perpendicular to the front of the vehicle. That's a good location from the standpoint of fitting and all of that. But the design of the receiver/transmitter includes a series of small indicator lights which the operator has to observe to make sure his set is on, to make sure he's on secure, and various other modes of operation. When we designed the receiver/transmitter, we embedded those lights so that they would not be too bright and therefore provide a security problem from the standpoint of an enemy detecting them. So when you combine recessed signal indicators with the location of the radio/transmitter, the operator can't see them without crawling over his seat and getting into the back of the vehicle.

That is a MANPRINT trade-off issue. On the one hand, we've located the equipment so that it's convenient for packaging, but from the operator's standpoint, it's more difficult to use. But if we're to avoid enemy detection, we may have to trade off one MANPRINT concern [human factors engineering] for another [safety]. What we have to do is keep working from the standpoint of the equipment designer and the equipment user being together in their aim.

Should there be an adversarial relationship between the two? I believe so. If everybody is too friendly and too inclined to agree to everything, then the wrong issues get served up. So there has to be a little tension between the developer and user so that the right issues surface in the decision making process. The user and the developer interface is crucial. That is why it is important to get things like MANPRINT embedded in the required operational capability.

Q: That is a good lead in for my next question, which deals with the program or project manager, the PMs. They are tasked with some pretty competing demands, that of cost, schedule, and technical performance. Does MANPRINT pose a dilemma for the PMs? Is the MANPRINT program itself compatible with the PM's charter?

A: It has to be, because equipment is developed for use by humans. It is a dilemma, but the PM must consider how the equipment's going to be used as well as the different aspects of MANPRINT, whether it's human

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engineering, training, personnel, health hazards, or safety. All of those aspects are key and essential to the PM. We have a TRADOC Systems Manager (TSM) who interfaces with the PM as a watchdog to ensure that what the PM is doing makes sense and conforms with MANPRINT requirements.

If you took a developer and told him to go and develop certain pieces of equipment, he quite naturally would seek to optimize for speed of production, efficiency of production, and the like. The PM may want to configure it so that it's convenient for the machinery or the particular piece of electronics that are needed without consideration for how the crew operates the equipment. The TSM is the guy who is responsible for ensuring that MANPRINT is kept on track.

Q: My next question may reopen some old wounds. The Sergeant York and Dragon are often said to exemplify the need for MANPRINT. Are steps being taken with the follow-on systems, ADATS and AAWS-M, to preclude the problems that beset the Sergeant York and Dragon?

A: ADATS and AAWS-M are totally different from a developmental standpoint. ADATS was selected for the Line-of-Sight-Forward (Heavy) air defense role and was an NDI [Non-Developmental Item]. We're now attempting to make some adjustments to ADATS. Sergeant York was an NDI of sorts—we took a series of subsystems that were already developed and tried to piece them together. I think it's a fair assessment to say that while people recognized the concerns in it, they probably didn't put as much emphasis on human factors as there should have been. And I don't mean to be critical—we didn't have MANPRINT then.

AAWS-M, on the other hand, is being designed from the ground up. I think we have learned a lot from the Dragon. I don't know whether you've had an opportunity to fire a Dragon—I have, and it is very difficult to do from an engineering standpoint. The position the gunner is required to maintain in order to track the target, and the weight and clumsiness of carrying the missiles makes the gunner's job difficult. Those things we can minimize, and we can sure improve the mount for the weapon so that it's more accurate.

So I would say that on those two items, we're doing the best we can with ADATS to make improvements that will facilitate operator-friendliness. A lot more attention is being focused on the AAWS-M, I think, because it's a ground-up system. We have three candidates right now we're working on and looking at, and MANPRINT is essential.

Q: The Army's senior leadership obviously believes in the MANPRINT program, that's quite evident. I'm just wondering what steps are being taken to ensure the program is successfully implemented by the soldiers and DA civilians in the field?

A: It gets back to the point I made earlier, that embedding the requirements for MANPRINT in our developmental programs is essential. We have policies out, and I say policies are the framework. The important thing is to ensure the mindset is on track and that people throughout the developmental and user communities adhere to the policies. We're taking advantage of what we know in order to improve the people side of materiel acquisition.

Of course, the ultimate decision review within the Army is the ASARC [Army Systems Acquisition Review Council], where we make our final review. A major aspect of the ASARC is MANPRINT. The DCSPER has to certify that major systems are okay from a MANPRINT standpoint. That sets the stage for it. But again, there are an awful lot of systems that are not reviewed in the Pentagon—IPR systems and so forth. And of course, we depend upon AMC and TRADOC to review those systems.

Q: Are the training programs going well?

A: Training programs are going okay. If I had my druthers, I would push to embed instruction on a broader base than we have now. A series of programs are being run for General Officers, SESs, for staff officers and for users. I believe that's the right approach. I had an opportunity to visit the MANPRINT Staff Officers Course down at Fort Belvoir, and I was impressed with that effort. We also have some MANPRINT instruction in the Army Logistics Management Course [ALMC], down at Fort Lee and a little in our new civilian management course. We don't have any in the Defense Systems Management College. The schoolhouse is where the embedding business should take place.

I'll guarantee you there's a lot of interest in it out in the field because users are always complaining "why do we

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have the radio here," or "why is this tire so difficult to take off"...you hear a lot of that.

I say training is going okay. It's never good enough or far-reaching enough. Fundamentally, training and education are part of what I call embedding MANPRINT into the Army. A culture change or a cultural awareness.

Q: In your opinion, how well is industry responding to the MANPRINT program? Any indications?

A: I think industry fundamentally is going to do what we want them to do because obviously, we're the customer. Therefore, it's incumbent on us to lay out very clearly what MANPRINT requirements we should go after. For those people who criticize industry for wanting to optimize production and such things, I think that's an unfair criticism. The user has to accept a certain amount of responsibility for not making MANPRINT issues clear up front. Once the system is designed, it becomes very difficult and expensive to adjust. And of course you get "Not invented here," or someone says, "Gee, that's a good idea. If only I had known it when I was at the drawing board, but now I can't fix it." MANPRINT is a broad-based requirement that all of us have to jump into.

Q: Often both the military and civilian side of the Army have indicated that there is a resource issue involved with doing MANPRINT. The resources may or may not be available to do the things they really want to do. Is the Army developing funding lines to support MANPRINT?

A: As you know, we had a little bit of money put aside in DCSPER the last couple of years, anywhere from $1 million to $2 million, which is not very much money when you consider the impact and the importance of what we are trying to do. But to set aside a certain amount of specified money in a project, for example, for MANPRINT, I'm not sure that's the way to go about it. If you do that, then it's very easy for one to allocate so much money for this and so much money for that, and then possibly run out. We'd be better off to leave that unsaid, but put the requirement on both the TSM and the PM to ensure that all aspects of MANPRINT are considered, and, as appropriate, incorporated into programs and projects.

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I believe it's everyone's responsibility to ensure that out of the money that's allocated to a project, the PM includes the MANPRINT interface. Does that cause a dilemma for him? Sure. That's why the user and Project Manager interface is so crucial.

Q: Sir, I understand there's going to be a MANPRINT seminar in September that will bring together senior industry executives and senior military officers to talk about the future of MANPRINT. Do you have any indication of where MANPRINT is going to be headed in FY89, FY90 and beyond? Any new directions?

A: With every piece of equipment that we're building, we're becoming more and more aware of the importance of MANPRINT. It's incumbent on all of us to keep the awareness of MANPRINT in high visibility. But again, while the tone is set by leadership, more than anything it is crucial that we embed the notion so that we continue to get more out of available resources in order to develop weapon and support systems that optimize the man/machine interface.

Q: In that same vein, one of the early responses from industry with regard to MANPRINT was that it's just another program that's going to have visibility for a year or two and simply fade away. Do you see that happening to MANPRINT?

A: No, to the contrary, I think that we have policies set down, and it's now incumbent on the chain of command to ensure that those policies are carried out. I believe that the direction is set.

But we have to keep pushing. Every day we're finding examples of equipment developments and procedures that can be improved by getting human engineers to work on particular items. The seed has been planted, but we have to continue to push on it. The *MANPRINT Bulletin*, it seems to me, is an ideal way of doing just that, making sure that both users and developers have an opportunity to share ideas, keep up with what's going on, learn references. The MANPRINT training courses and seminars are crucial. So I don't think it's going to die, particularly if we work to institutionalize it. That was the point I was getting at when I said earlier that it needs to be institutionalized rather than personality-driven.

Q: Sir, I really appreciate your time, but before I close the interview, I'd like to know if there's anything that you would like to add? Any personal thoughts?

A: I'd just like to emphasize that MANPRINT is here to stay. I think it's a key and essential part of total systems development because we look at people as our most important commodity—how we take care of them, how we develop equipment, and how we use that equipment. The effort should be on institutionalizing the concept.

Let me just show you something. Talking about MANPRINT, I bought a lock not too long ago. It's just an ordinary little lock. This lock, I found, is a non-MANPRINT lock. In the design, it has a very non-essential distractor to it, and that is that little wedge right there. Because as you turn the dial, it's very easy to dial up on the edge of the flange rather than on the tick, particularly when you're in a hurry. A non-MANPRINTed item. ***(Laughter)***

***SMMP Update** (continued from page 3)*

ment and staffing of SMMPs. They are in the TRADOC/AMC publication which will be published as TRADOC/AMC Regulation 602-XX. The publication is currently awaiting HQDA approval of a joint publication.

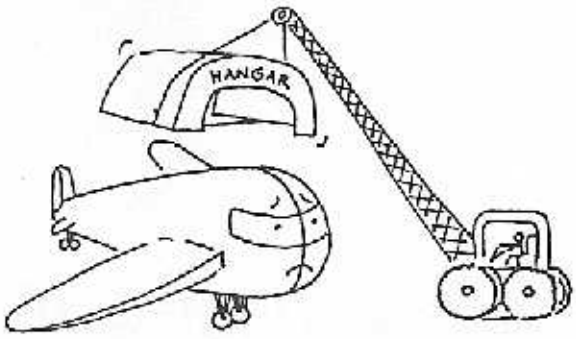
A. Identify all members of the MJWG prior to staffing any SMMP. Do not use the SMMP to recruit membership for the MJWG. After identifying MJWG members, the DCD sends them a copy of the proposed system description before scheduling the first meeting. Each member needs to be familiar with the proposed system so that at the first meeting of the MJWG, the member can address issues in their area of expertise. These issues include initial MANPRINT objectives, potential concerns, questions that need to be resolved, and lessons learned.

B. When the MJWG has prepared the SMMP, the chairman releases it for staffing with the members of the MJWG and the outside agencies/activities involved in the MANPRINT effort.

C. When staffing a SMMP, the accompanying letter should state the purpose of the staffing action. If a "skeleton" SMMP is developed and staffed, the transmittal letter must identify it as such. For example, the purpose may be to obtain review and comment prior to the initial meeting of the MJWG or to obtain comment or concurrence prior to submission to the commandant for approval.

7. HQ TRADOC Combat Developments MANPRINT POCs are Ms. Swafford, CPT Streater, Mr. Dwyer; ATCD-SP; AV 680-4225/4227. For additional guidance on SMMP implementation, contact Ms. Richman-Loo, U.S. Army Soldier Support Center-National Capital Region, AV 221-2092.

"If I had only known then what I know now..."



Cartoon courtesy of Judy Hicks

GENERAL INFORMATION

- We welcome proposed articles--especially those kept to lengths of two or three pages (double-spaced)! Please send drafts to: MANPRINT Bulletin, ATTN: HQDA (DAPE-MR), Washington, D.C. 20310-0300.

- Changes of address for the MANPRINT Bulletin or Points of Contact List should be mailed, using the Reader's Response form found on the inside back cover, to the attention of Ms. Kristy Underwood at Automation Research Systems, Ltd., 4401 Ford Avenue, Suite 400, Alexandria, VA 22302 or telephone (703) 820-9000.

- Course Description packets for the MANPRINT Staff Officers Course(MSOC) and the MANPRINT Senior Training Course (MSTC) are available from the above ARS address.

MANPRINT Computer Conferencing Net Established

A MANPRINT computer conferencing net was established on June 14, 1988 by the MANPRINT Office, HQDA, as a subnet of the Army Forum Net. This net will allow MANPRINT practitioners and other interested individuals the opportunity to discuss issues, concerns, development, and general information related to MANPRINT. Membership is open to all individuals who feel they can contribute as well as benefit through use of this net. There is no charge for participation.

In addition to computer conferencing capability (members simply post items for which they wish participants to respond), the MANPRINT net provides an electronic mail capability.

If you wish to participate, contact LTC Rudy Laine, AV 225-9213 or COM (202) 695-9213, to receive an invitation packet and LOGON ID.

MANPRINT Methods Development

Jonathan D. Kaplan, Ph.D.
U. S. Army Research Institute

Editor's Note: The following is an updated version of an article published in the "Proceedings of the Human Factors Society 31st Annual Meeting (1987) Volume 1."

How does the Army ensure that it acquires hardware and software that available soldiers will be able to operate and maintain acceptably? More specifically, how can the Army develop and communicate information that usefully aids the hardware and software design process so as to raise the probability of successful manning? Further, how can the Army evaluate the resulting designs? The U.S. Army Research Institute (ARI) is developing methods that will help to answer these questions.

Integrating the major components of a system is often the most difficult part of the design process. Soldiers are system components with three gross classes of attributes: (1) intrinsic personnel characteristics, (2) extrinsic characteristics—features imposed by the environment (e.g., training), and (3) number. Hardware and software components must be selected or designed so that they can be integrated successfully with these attributes. It is critical, therefore, that hardware and software designers begin the design process with knowledge of probable soldier characteristics in the context of system performance criteria.

The decision to move from system design to prototype hardware and software is a major one from both a financial and battlefield risk standpoint. The hardware and software development community has produced materiel that, in theory, is capable of very high levels of performance. In practice, however, these high levels are rarely produced by operational personnel, often because personnel who are capable of operating and maintaining equipment to theoretical levels are not available to the Army in sufficient numbers. The Army must be able to determine the numbers and kinds of personnel required by design features to reach criterion performance prior to deciding to move from an existing initial design to building a prototype.

ARI is developing a suite of six methods that will aid in generating and communicating this critical information to designers, as well as evaluating the resulting design. These methods are outlined below.

SPARC (System Performance and RAM Criteria) Aid

The purpose of this simulation-based method will aid Army personnel in performance criterion development so that hardware and software designers will know how the system must perform for minimal acceptability.

M-CON (Manpower Constraints) Aid

This aid will provide hardware and software designers with crew size constraints so that systems are not designed for unavailable numbers of soldiers. This method is based upon availability analyses of the Military Occupational Specialty (MOS) that will man the system, and will be able to predict those constraints for future years.

P-CON (Personnel Constraints) Aid

This product will provide hardware and software designers with those soldier characteristics with which their design will have to integrate. This aid will help to (1) identify the MOS that is likely to crew the system, (2) predict the levels of ASVAB and MEPSCAT scores that describe the personnel available to crew the system, and (3) convert those scores into performance capabilities that are meaningful to the design process. P-CON will be able to predict soldier characteristics available for future years.

T-CON (Training Constraints) Aid

This aid will describe the system's probable training needs to the designer so that the hardware and software design does not require a level of skill that cannot be achieved by using available training.

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***Methods** (continued from page 10)*

It will produce training times and general classes of training media.

MAN-SEVAL (Manpower Based System Evaluation) Aid

This simulation-based product is being developed to evaluate system designs by determining the jobs and numbers of personnel per job required to operate and maintain the hardware and software as designed. MAN-SEVAL determines jobs by computing workloads using three techniques: (1) Multichannel analysis, (2) Time-based analysis, and (3) System Availability-based analysis.

PER-SEVAL (Personnel Based System Evaluation) Aid

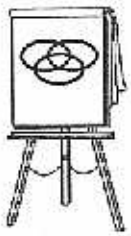
This aid, which interacts with the method just described, will evaluate system designs by determining the ASVAB and MEPSCAT scores that are required for soldiers to operate and maintain a given design to performance criteria following specified amounts of practice. This simulation-based aid uses a series of algorithms that relates soldier characteristics to performance derived from ARI's Project A.

ARI's suite of software-based aiding methods will aid in developing information to influence and evaluate interface designs; the information generated by these methods can theoretically lead to other highly desirable analyses. Ultimately, they may help to ensure the successful integration of hardware and software and that most critical component: the soldier.

For more information, contact Dr. Jonathan Kaplan, U.S. Army Research Institute, AV 284-8873 or COM (202) 274-8873.

International Ergonomics Conference to be Held in August

The First International Conference on Ergonomics of Advanced Manufacturing and Hybrid Automated Systems will be held August 15-18, 1988 in Louisville, KY. The conference will cover current research and implementation issues related to the ergonomic, health, social, economic, management and human resources aspects of advanced manufacturing and other hybrid automated systems. See 'Meetings of Interest' on page 14 for contact information.



MANPRINT Training Courses for FY89

The FY89 schedule for the MANPRINT Staff Officers Course (MSOC) and the MANPRINT Senior Training Course (MSTC) has been set for FY89. Although no changes are anticipated at this time, please follow the regular course schedule printed in each issue of the Bulletin for any changes in date or location. The course schedules are as follows:

MANPRINT Staff Officers Course (MSOC)

Oct 17 - 4 Nov 88	1 - 19 May 89
28 Nov - 16 Dec 88	5 - 23 June 89
23 Jan - 10 Feb 89	10 - 28 July 89
6 - 24 Mar 89	7 - 25 Aug 89
3 - 21 Apr 89	11 - 29 Sep 89

All MSOC courses will be held at the Casey Building, Ft. Belvoir, VA.

MANPRINT Senior Training Course (MSTC)

14-18 Nov 88 (St. Louis, MO)
9-13 Jan 89 (Ft. Rucker, AL)
13-17 Feb 89 (Rock Island, IL)
20-24 Mar 89 (Ft. Benning, GA)
17-21 April 89 (Orlando, FL)
15-19 May 89 (Ft. Eustis, VA)
19-23 June 89 (Aberdeen, MD)
24-28 July 89 (Ft. McClellan, AL)
21-25 Aug 89 (Warren, MI)
25-29 Sep 89 (Ft. Eustis, VA)

To register for any MANPRINT training course, contact:

U.S. Army Soldier Support Center - National Capital Region
200 Stovall Street
Alexandria, VA 22332-1345.
Telephone: AV 221-3706 or COM (703) 325-3706

For Course Description Packets, contact:

Automation Research Systems, Ltd.
4401 Ford Avenue, Suite 400
Alexandria, VA 22302
ATTN: Ms. Kristy Underwood
Telephone: (703) 820-9000

Robotic Systems and their MANPRINT Implications

Theodore Marton, Ph.D.
and
James E. Edwards, Ed.D.
Dynamics Research Corporation

Modern weapon systems are putting increasing emphasis on the use of robotic systems to enhance, prepare, and sustain both human and equipment performance. These robotic systems, regardless of their level of automation, must be monitored, maintained, repaired and initially programmed by humans.

This link between robotic systems and man, and the fact that these systems manifest a unique set of characteristics that may be potentially hazardous to both men and equipment, makes it crucial that MANPRINT be initiated early in the acquisition process. Because of the number and complexity of factors involved in the implementation of modern robotics, the earlier MANPRINT is applied in the planning and acquisition process, the greater the probability of satisfying the needs identified in chapter 1 of AR 602-2, Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process (86).

For this discussion, robotic systems will be defined as one or more programmable devices, which, when actuated, will select and perform the task sequences needed to achieve the outputs or products for which the robot is designed. These actions may be modified using real time data sensed by the robot directly from the ongoing task environment or accessed from local or remote sources, with or without further human intervention. Based on this definition, robotic systems can be expected to manifest the following unique characteristics:

• Continued Automaticity

An actuated robotic system is capable of manipulating its ongoing functions in real time to implement its currently active programming and priorities without the need for further human intervention. Such continued automatic activity requires the integrated and prioritized control of all factors potentially capable of affecting or being affected by the system equipment, personnel, or environment during operation. The system's continuing automatic functions must be identified as they vary in respect to time and locus so that MANPRINT-related implications may be detected, described and accommodated.

• Near Real Time Auto Programming

The robotic system's ability to redirect or significantly alter system programming in real time allows the already complex and relatively unpredictable ongoing functional sequences at robot work stations to be modified suddenly—with or without local warning or preparation.

The resulting potential for undesirable consequences is obvious. Therefore, all significant sources, modes and locations of control functions and their methods of activation that could modify activity at the work station, or otherwise impact the MANPRINT domains of human factors, safety or health hazards, must be identified. In addition, the MANPRINT process must ensure that the problems generated by the real time variability of work station activities are considered and accommodated by the proposed system design and test plans.

• The Potentially Nonrepetitive Nature of Functional Sequences at an Advanced Robotic Work Station

Robots may be programmed to use a variety of conditionally-determined process or sequence paths to implement a given task or function. They may also have the option to select and implement methods and/or sequences available in local or remote storage that are programmatically determined to be the most effective solution based on currently prevailing criteria and conditions. Finally, a robotic system may stop work on an ongoing low priority task should a higher priority task be introduced.

The resultant variability or non-repetitive nature of robotic activity disrupts an on-site individual's ability to predict this activity based only on observed current activity. This uncertainty generates a need to provide integrated, system-specific and robotically-oriented safety designs for all physical or operational interface

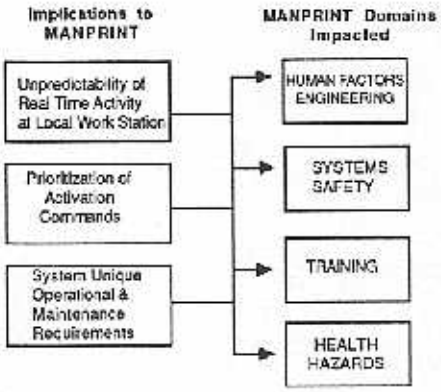
Continued on page 13

***Robotics** (continued from page 12)*

designs, training, or test procedures as an integral part of the acquisition process.

• Problems Due to Potential Conflicts Between Manned and Unmanned and Remote vs. Local System Control Actuation

Robotic systems are capable of manned or unmanned activity in response to control variables inputted from a variety of local or remote sources. This creates a unique set of concerns that must be continuously monitored and accommodated by the MANPRINT domains of at least human factors, safety, health hazards assessment and training. Unless control inputs are appropriately coordinated and prioritized, a broad spectrum of conflicting and potentially harmful command sequences could be generated. MANPRINT efforts must include the integration of the robotic systems control architecture, configuration, and dynamics, as well as their impacts on the personnel/robot interfaces.



Robotic Systems and MANPRINT

T. Marlon and J.L. Pulaski, in a paper examining and accommodating the human factors and safety-related concerns associated with advanced industrial robotic systems, recommended that human factors, safety, or health hazard assessments of a robotic system design be initiated by the "implementation and analysis of a robotic safety status and need inventory." The use of such a formal guide would a) assure the breadth of coverage needed by such complex and interactive systems, b) encourage system-specific design based on actual rather than generic needs, and c) force the analyst to examine the robotic design from a system viewpoint rather than as a series of isolated functions.

In support of this position, Marlon and Pulaski offered a preliminary version of a twenty-three point *Robotic Safety Inventory Guide* based on the recently-released *American National Standard for Industrial Robots and Robotic Systems-Safety Requirements* (ANSSI/RIA R15.06-1986). This guide is directly pertinent and transposable to military systems of equivalent complexity and sophistication.

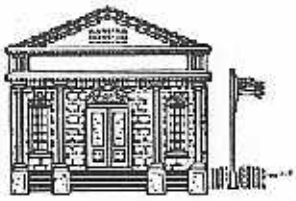
Because the proponency for implementing the various MANPRINT domains is vested in more than one group in the acquisition process, it is essential that those involved in MANPRINT use the same baseline concepts in their developmental efforts. A standard or common version of a system-specific safety inventory guide (or equivalent instrument) should be used in the early phases of all MANPRINT procedures applied to robotic systems.

While dealing with robots, the MANPRINT analyst is faced with systems that are capable of varying their functions, configuration, operational status and potential impact on the local environment, in real time, based on sometimes unpredictable and uncontrollable signals initiated from a variety of sources.

MANPRINT analysts must ensure that the robotic system's design and its associated operations meet all feasible criteria for efficacy and safety, and that personnel training provides the skills, knowledge, insight, and motivation needed to operate and maintain the system safely and efficiently. The wide range of physical and operational characteristics associated with these systems must be considered and accommodated, for these variations can directly impact upon the critical MANPRINT domains of human factors, safety, health hazard assessment and training.

Reference: Marlon, T., Pulaski, J.L., Assessment and Development of HF Related Safety Designs for Industrial Robots and Robotic Systems. Proceedings of the Human Factors Society 31st Annual Meeting, New York, 1987.

For more information, contact Ted Marlon or James Edwards at Dynamics Research Corporation, 1755 Jefferson Davis Hwy., Arlington, VA 22203, (703) 521-3812.



Schedule of MANPRINT Courses for FY88/89

MANPRINT Senior Training Courses

1-5 Aug 88 (Monmouth)
29 Aug-2 Sep 88 (Gordon)
14-18 Nov 88 (St. Louis)

MANPRINT Staff Officers Courses**

8-26 Aug 88	17 Oct - 4 Nov 88
12-30 Sept 88	28 Nov - 16 Dec 88

Note: The 11-29 Jul 88 MSOC has been cancelled.

**All courses will be held at the Casey Bldg., Humphrey's Engineer Support Activity Complex, Ft. Belvoir, VA.

See page 11 for complete FY89 MANPRINT training course schedules.

MANPRINT INFORMATION

POLICY - MANPRINT Directorate, HQDA (DAPE-MR). Washington, DC 20310-0300. AV 225-9213, COM (202) 695-9213.

MANPRINT TRAINING - Soldier Support Center-National Capital Region, ATTN: ATNC-NM, 200 Stovall St., Alexandria, VA 22332-0400. AV 221-3706, COM (703) 325-3706.

PROCUREMENT & ACQUISITION - US Army Materiel Command, ATTN: AMCDE-PQ, 5001 Eisenhower Ave., Alexandria, VA 22333-0001. AV 284-5696, COM (202) 274-5696.

HUMAN FACTORS ENGINEERING STANDARDS AND APPLICATIONS - Human Engineering Laboratory - MICOM Detachment, ATTN: SLCHE-MI, Redstone Arsenal, AL 35898-7290. AV 746-2048, COM (205) 876-2048.

MANPOWER, PERSONNEL AND TRAINING RESEARCH - Army Research Institute, ATTN: PERI-SM, Alexandria, VA 22333-5600. AV 284-9420, COM (202) 274-9420.

15-18 August 1988

First International Conference on Ergonomics of Advanced Manufacturing and Hybrid Automated Systems. Louisville, KY. Contact: D. Novak, Continuing Education, School of Dentistry, University of Louisville, Louisville, KY 40292. Telephone: (502) 588-5077.

17-19 October 1988

Association of the United States Army (AUSA) Annual Meeting. Sheraton Washington, Washington, D.C. Registration forms can be obtained from *Army Magazine* or from Chapter points of contact. For exhibit information, contact Joe Hollis, AUSA, (703) 841-4300, ext. 667.

24-28 October 1988

"Riding the Wave of Innovation," 32nd Annual Meeting of the Human Factors Society. Anaheim, CA. Contact: Human Factors Society Central Office, P.O. Box 1369, Santa Monica, CA 90406. Telephone: (213) 394-1811.

GENERAL INFORMATION

• Proposed articles, comments, and suggestions are welcomed, and should be mailed to: MANPRINT Bulletin, ATTN: HQDA (DAPE-MR), Washington, D.C. 20310-0300. Telephone: AV 225-9213, COM (202) 695-9213.

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Ms. Nan B. Irick, Editor, ARS

Harold R Booher

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Director for MANPRINT

The MANPRINT Bulletin is an official bulletin of the Office of the Deputy Chief of Staff for Personnel (ODCSPER), Department of the Army. The Manpower and Personnel Integration (MANPRINT) program (AR 602-2) is a comprehensive management and technical initiative to enhance human performance and reliability during weapons system and equipment design, development, and production. MANPRINT encompasses the six domains of manpower, personnel, training, human factors engineering, system safety, and health hazard assessment. The focus of MANPRINT is to integrate technology, people, and force structure to meet mission objectives under all environmental conditions at the lowest possible life-cycle cost. Information contained in this bulletin covers policies, procedures, and other items of interest concerning the MANPRINT Program. Statements and opinions expressed are not necessarily those of the Department of the Army. This bulletin is published monthly under contract by Automation Research Systems, Ltd., 4480 King Street, Suite 500, Alexandria, Virginia 22302, for MANPRINT Directorate, Office of the Deputy Chief of Staff for Personnel under the provisions of AR 310-2 as a functional bulletin.